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(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2004/0172133 A1

Gerber et al. (43) Pub. Date: Sep. 2, 2004

(54) INTERVERTEBRAL IMPLANT FOR TRANSPORAMINAL POSTERIOR LUMBAR INTERBODY FUSION PROCEDURE

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(21) Appl. No.: 10/787,984

(22) Filed: Feb. 26, 2004

Related U.S. Application Data

(63) Continuation of application No. 09/848,178, filed on May 3, 2001, now Pat. No. 6,719,794.

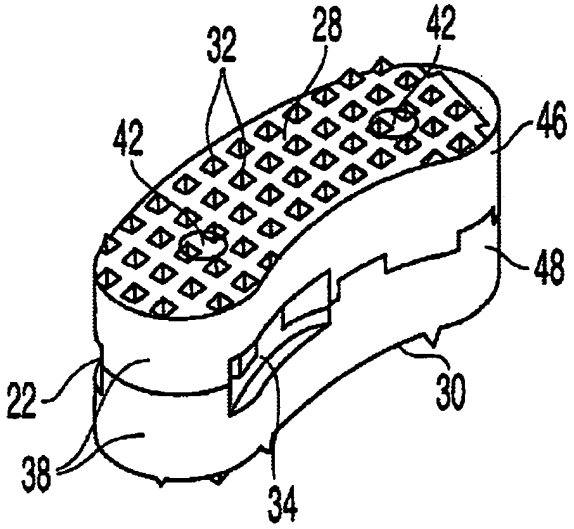
Publication Classification

(51) Int. Cl.[7] A61F 2/44; A61F 2/46

(52) U.S. Cl. 623/17.11

(57) ABSTRACT

An intervertebral implant for fusing vertebrae is disclosed. The implant has a body with curved, substantially parallel posterior and anterior faces separated by two narrow implant ends, superior and inferior faces having a plurality of undulating surfaces for contacting upper and lower vertebral endplates, and at least one depression at a first end for engagement by an insertion tool. The arcuate implant configuration facilitates insertion of the implant from a transforaminal approach into a symmetric position about the midline of the spine so that a single implant provides balanced support to the spinal column. The implant may be formed of a plurality of interconnecting bodies assembled to form a single unit. An implantation kit and method are also disclosed.



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(12) **United States Patent**
Shimp et al.

(10) **Patent No.: US 6,855,167 B2**
(45) **Date of Patent: Feb. 15, 2005**

(54) **SPINAL INTERVERTEBRAL IMPLANT, INTERCONNECTIONS FOR SUCH IMPLANT AND PROCESSES FOR MAKING**

(75) Inventors: **Lawrence A. Shimp**, Morganville, NJ (US); **John M. Whitterbottom**, Jackson, NJ (US); **David R. Kaes**, Toms River, NJ (US); **Todd M. Boyce**, Aberdeen, NJ (US); **Erik O. Martz**, Howell, NJ (US)

(73) Assignee: **Osteotech, Inc.**, Eatontown, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 36 days.

(21) Appl. No.: 10/005,238

(22) Filed: Dec. 5, 2001

(65) **Prior Publication Data**

US 2003/0105528 A1 Jun. 5, 2003

(51) Int. Cl.[7] A61F 2/44; A61F 2/28

(52) U.S. Cl. 623/17.11; 623/23.63; 623/919; 403/408.1

(58) **Field of Search** ..... 403/408.1, 13, 403/14; 623/17.11, 17.16, 16.11, 13.17, 18.11, 23.51, 23.61, 23.63, 919, FOR 16, FOR 17; 606/76

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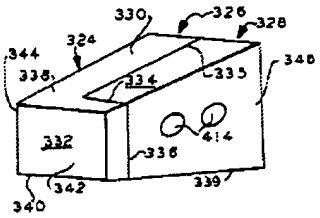
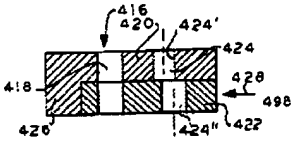
Primary Examiner—David H. Willse
(74) *Attorney, Agent, or Firm*—Carella Byrne Bain Gilfillan Stewart et al; Elliot M. Olstein; William Squire

(57) **ABSTRACT**

A cortical bone implant is formed of two or more planks of bone which are connected with one or more offset pins. The pins may be right circular cylinders inserted into a corresponding offset bore which offset beads the inserted pin. The bending creates compression and tensile loads in the pin which loads creates friction compression forces on the planks connecting them to the pins by friction. The pins may have different shapes to form the offsets and different configurations for friction attachment to the planks. The implants may be formed of flat or L-shaped planks or bones formed into other shapes including interlocking arrangements. Processes and fixtures are disclosed for forming the pins, planks and implants. Various embodiments of the pins, planks, implants and processes are disclosed.

28 Claims, 21 Drawing Sheets





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(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2002/0029084 A1

Paul et al. (43) Pub. Date: Mar. 7, 2002

(54) BONE IMPLANTS WITH CENTRAL CHAMBERS

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(21) Appl. No.: 09/814,214

(22) Filed: Mar. 22, 2001

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/363,844, filed on Jul. 30, 1999.

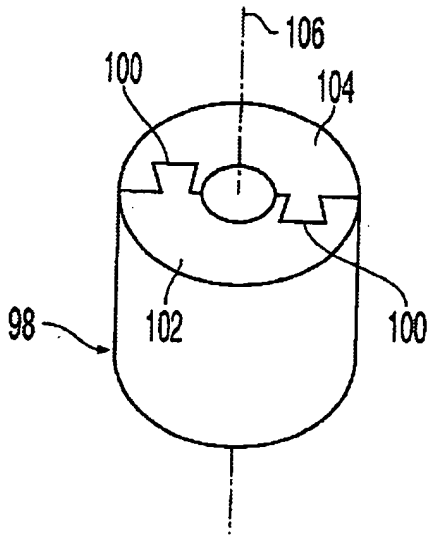
Publication Classification

(51) Int. Cl.[7] A61F 2/28

(52) U.S. Cl. 623/23.63; 606/72

(57) ABSTRACT

The present invention relates to an implant comprising two or more bone fragments that are combined to form a single unit. Cancellous bone or cortical bone is removed from a source and fashioned into bone components with desirable shapes and sizes. The bone components may be integrated to form implants for implantation in the body. Bone stock may be formed by combining sections of various bones of the body, and the bone stock may be further fashioned for use as implants with particular geometries.



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US005899939A

United States Patent [19]

Boyce et al.

[11] Patent Number: 5,899,939

[45] Date of Patent: May 4, 1999

[54] **BONE-DERIVED IMPLANT FOR LOAD-SUPPORTING APPLICATIONS**

[75] Inventors: Todd M. Boyce, Aberdeen; Albert Manrique, Manalapan; Nelson L. Scarborough, Ocean; James L. Russell, Little Silver, all of N.J.

[73] Assignee: Osteotech, Inc., Eatontown, N.J.

[21] Appl. No.: 09/009,997

[22] Filed: Jan. 21, 1998

[51] Int. Cl.[6] A61F 2/28

[52] U.S. Cl. 623/16; 523/11; 523/113; 523/115

[58] Field of Search 623/11, 16; 523/113, 523/115

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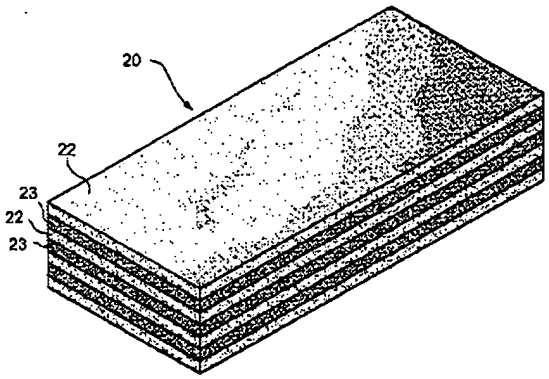
Primary Examiner—Paul B. Prebilic

Attorney, Agent, or Firm—Dilworth & Barrese

[57] **ABSTRACT**

A bone-derived implant is provided which is made up of one or more layers of fully mineralized or partially demineralized cortical bone and, optionally, one or more layers of some other material. The layers constituting the implant are assembled into a unitary structure to provide an implant exhibiting good overall load-supporting properties.

13 Claims, 3 Drawing Sheets



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4	US 5112354 A		USPAT	19920512	7	US 51123!
5	US 5405391 A		USPAT	19950411	11	US 54053!
6	US 5439684 A		USPAT	19950808	9	US 54396(
7	US 5571190 A		USPAT	19961105	7	US 55711!
8	US 5798096 A		USPAT	19980825	12	US 57980!
9	US 5865848 A		USPAT	19990202	14	US 58658(
10	US 5888222 A		USPAT	19990330	18	US 58882:
11	US 5899939 A		USPAT	19990504	8	US 58993'

than any optional layer(s) that may be present. Thicknesses ranging from about 0.5 to about 20, and preferably from about 1.5 to about 15 mm can advantageously be used. In general, the number and thickness of the compression-strength imparting layers in a given bone-derived implant will be such as to provide an overall compression strength for the implant of from about 25 to about 250, and preferably from about 100 to about 200 MPa.

(3) The sources of cortical bone for the bone-derived implant of this invention are preferably allogenic but also include xenogenic sources such as bovine and porcine bone. Where partially or fully demineralized cortical bone is utilized, such bone can be obtained employing known demineralization techniques, e.g., those employing strong acids such as hydrochloric acid as described in Reddi et al., Proc. Nat. Acad. Sci. 69, pp. 1601-5 (1972), herein incorporated by reference. The extent of demineralization is a function of the strength of the acid solution, the shape of the bone and the duration of the demineralization treatment. Reference in this regard may be made to Lewandrowski et al., J. Biomed Materials Res, 31, pp365-372 (1996), also incorporated herein by reference. The use of partially or fully demineralized bone can be beneficial herein since such substances exhibit greater initial osteogenic and/or osteoinductive activity than fully mineralized bone.

(4) The compression strength-imparting layer(s) of the bone-derived implant can be provided as monolithic sections of bone or as multi-sectional layers built up from two or more subsections, e.g., joined to each other in edge-to-edge fashion in a manner which is analogous to planking. In this way, relatively large compression strength-imparting layers can be constructed from smaller bone sections to provide an implant whose overall size is not limited by the size and/or shape of the cortical bone which is available for its construction.

(5) Assembling the superimposed layers into a strong unitary structure can be accomplished by a variety of means/procedures, e.g., application of known and conventional biologically compatible adhesives such as the cyanoacrylates; epoxy-based compounds, dental resin sealants, dental resin cements, glass ionomer cements, polymethyl methacrylate, gelatin-resorcinol-formaldehyde glues, collagen-based glues, inorganic bonding agents such as zinc phosphate, magnesium phosphate or other phosphate-based cements, zinc carboxylate, etc., and protein-based binders such as fibrin glues and mussel-derived adhesive proteins; the use of mechanical fasteners such as pins, screws, dowels, etc., which can be fabricated from natural or synthetic materials and bioabsorbable as well as nonbioabsorbable materials; laser tissue welding; and, ultrasonic bonding. If desired, the layers of the bone-derived implant can be provided with mechanically interengaging features, e.g., tongue-and-groove or mortise-and-tenon elements, to facilitate their assembly into the final product and/or to fix the layers to each other in a more secured fashion. In addition to its compression strength-imparting fully mineralized or partially mineralized cortical bone layers, the bone-derived implant of this invention can optionally possess one or more layers formed from one or more other materials. For example, these optional layers can be based on or include highly or fully demineralized bone, graphite or pyrolytic carbon, a mineral material such as hydroxyapatite, tricalcium phosphate, bioglass or other bioceramic or natural or synthetic polymers, e.g., bioabsorbable materials such as starches, polyglycolide, polylactide, glycolide-lactide copolymer, and the like, and nonbioabsorbable polymers such as polymethyl methacrylate, polytetrafluoroethylene, polyurethane, polyethylene and nylon.

(6) If desired, the compression strength axis of one or more compression strength-imparting layers can be offset relative to the compression strength axis of one or more of the other compression strength-imparting layers in an arrangement much like that of plywood. For example, compression strength axes of alternating compression strength-imparting layers can be offset by up to 90.degree. from the compression strength axes of the other compression strength-imparting layers in the implant in order to distribute the overall load-supporting capacity of the implant in mutually transverse directions.

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5	US 3862631 A		USPAT	19750128	4	US 3862
6	US 4098269 A		USPAT	19780704	4	US 4098
7	US 4187841 A		USPAT	19800212	8	US 4187
8	SU 825044 B		DERWEN	19810505	NA	
9	US 4365624 A		USPAT	19821228	20	US 4365
10	BE 895728 A	A1, B1	DERWEN	19830516	12	EP 1178
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12	US 4535763 A		USPAT	19850820	21	US 4535
13	EP 153546 A	A1, B1	DERWEN	19850904	34	EP 1535
14	EP 194187 A	A1, B1	DERWEN	19860910	19	EP 1941
15	SU 1342513 A		DERWEN	19871007	NA	
16	US 4714076 A		USPAT	19871222	14	US 4714
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18	CH 665766 A5		EPO	19880615	4	CH 6657
19	CH 665766 A		EPO	19880615	4	CH 6657
20	CH 665766 A		DERWEN	19880615	4	CH 6657
21	EP 314593 A	A1, B1	DERWEN	19890503	5	EP 3145
22	US 4828495 A		USPAT	19890509	14	US 4828
23	JP 01265953 A		JPO	19891024	5	JP 0126
24	US 4890631 A		USPAT	19900102	9	US 4890
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26	US 5013318 A		USPAT	19910507	7	US 5013
27	US 5067962 A		USPAT	19911126	5	US 5067
28	EP 463551 A1	A1, B1	EPO	19920102	8	EP 4635
29	EP 463551 A	A1, B1	DERWEN	19920102	8	EP 4635
30	US 5147367 A		USPAT	19920915	9	US 5147
31	JP 04300533 A		JPO	19921023	8	JP 0430
32	US 5180388 A		USPAT	19930119	6	US 5180
33	JP 05007604 A	A, U	JPO	19930119	5	JP 0500
34	US 5242447 A		USPAT	19930907	5	US 5242
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37	US 5338197 A		USPAT	19940816	10	US 5338
38	US 5372538 A		USPAT	19941213	6	US 5372
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40	DE 29615148 U		DERWEN	19961024	30	DE 2961
41	US 5611801 A		USPAT	19970318	5	US 5611
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46	US 5716358 A		USPAT	19980210	11	US 5716
47	US 5728099 A		USPAT	19980317	13	US 5728

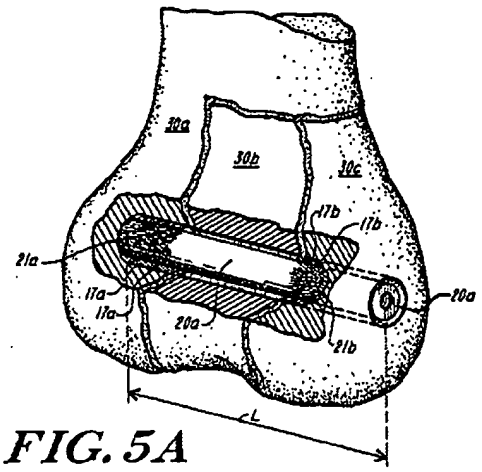

FIG. 5A

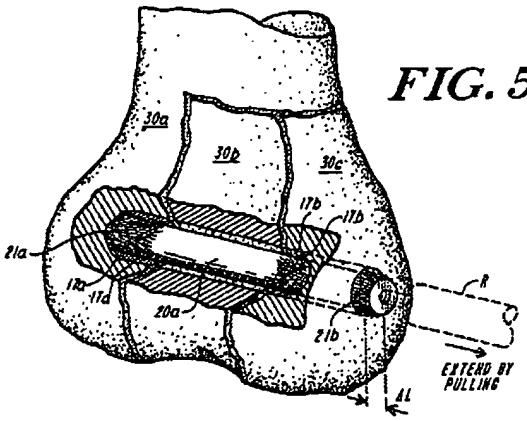

FIG. 5B

EAST Browser - L3: (100) bone near3 p... | EP 314593 A1 | Tag: S | Doc: 21/100 (SORTED) | "Full" 1/5 (Total images 5) | Front Page, Bibliography, Abstract

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1	US 1550400 A		USOCR	19250818	5	US 1550
2	US 2443106 A		USOCR	19480608	9	US 2443
3	US 2690198 A		USOCR	19540928	8	US 2690
4	US 2857621 A		USOCR	19581028	2	US 2857
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7	US 4187841 A		USPAT	19800212	8	US 4187
8	SU 825044 B		DERWEN	19810505	NA	
9	US 4365624 A		USPAT	19821228	20	US 4365
10	BE 895728 A	A1, B1	DERWEN	19830516	12	BE 1178
11	US 4503847 A		USPAT	19850312	30	US 4503
12	US 4535763 A		USPAT	19850820	21	US 4535
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22	US 4828495 A		USPAT	19890509	14	US 4828
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35	RU 2000749 C		DERWEN	19931015		
36	DE 4223794 A		DERWEN	19940127		
37	US 5338197 A		USPAT	19940816		
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39	US 5417692 A		USPAT	19950523		
40	DE 29615148 U		DERWEN	19961024		
41	US 5611801 A		USPAT	19970318		
42	WO 9714367 A1		EPO	19970424		
43	US 5662648 A		USPAT	19970902		

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(54) Implant prothétique articulaire à fixation temporaire.

(57) - L'objet de l'invention est un implant prothétique articulaire à fixation temporaire, plus particulièrement destiné aux pieds et aux mains, caractérisé en ce qu'il est constitué, d'une part, d'une cupule (1) percée en son centre d'un trou (2) et destinée à être mise en place entre deux pièces osseuses (4,5) au droit de leur articulation et, d'autre part, d'une broche (3) de fixation, apovible, susceptible de coulisser librement dans le trou (2) de ladite cupule (1) et destinée à immobiliser provisoirement la cupule (1) et les pièces osseuses adjacentes (4,5) en étant ancrée au travers des canaux médullaires des pièces osseuses intéressées (4,5,6) et du trou (2) de la cupule (1) préalablement mise en place.
- Application à la chirurgie orthopédique en particulier des pieds et des mains.

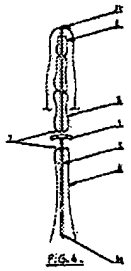

Fig.4.

EP 0 314 593 A1

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1	US 1550400 A		USOCR	19250818	5	US 1550
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42	WO 9714367 A1		EPO	19970424		
43	US 5662648 A		USPAT	19970902		

US-PAT-NO: 4503847

DOCUMENT-IDENTIFIER: US 4503847 A
See image for Certificate of Correction

TITLE: Prosthetic nail

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Brief Summary Text - BSTX (4):
It is well known to employ pins or nails for the purpose of attempting to stabilize certain types of fractures, for example, comminuted or complex fractures which are best treated by stabilization or internal fixation of the bone. Such pins or nails are described and illustrated in U.S. Pat. Nos. 2,579,968; 2,998,007; 3,433,220 and 3,439,671. However, the pins which are illustrated for example in the aforementioned '968 patent, although providing for connection of the broken pieces of bone do not provide for rotational stability because of their rod-like construction. In addition, most of these known nails or pins do not provide for any securement of the same to a portion of the bone.